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# AFRL

THE AIR FORCE RESEARCH LABORATORY  
LEAD | DISCOVER | DEVELOP | DELIVER



## AFRL's New Tool for HAZCOM Compliance at R&D Level:

# C H A M P

Chemical Hazard Analyses & Management Program



Ashwani Vij, PhD<sup>1</sup> & Suresh Tennarangam<sup>2</sup>

Environment, Safety & Occupational Health

1. Air Force Research Laboratory, Detachment 7/SE

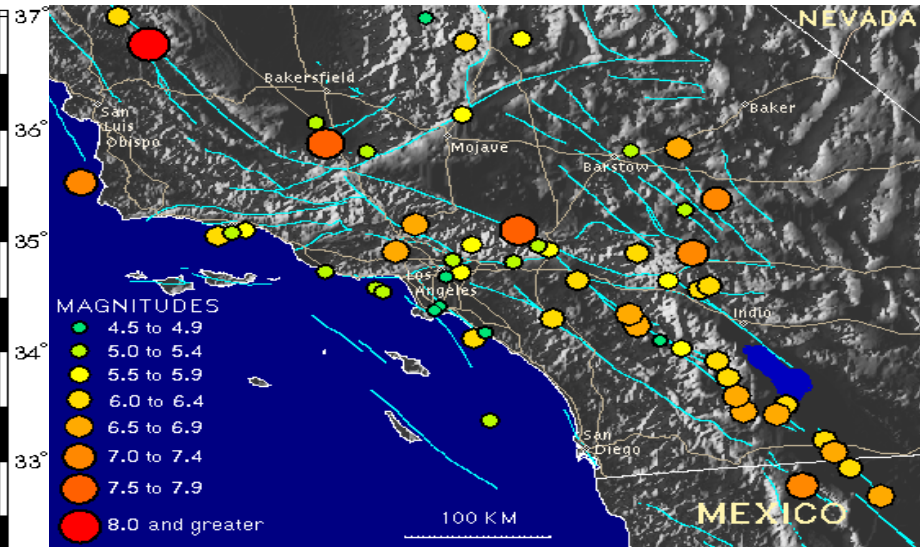
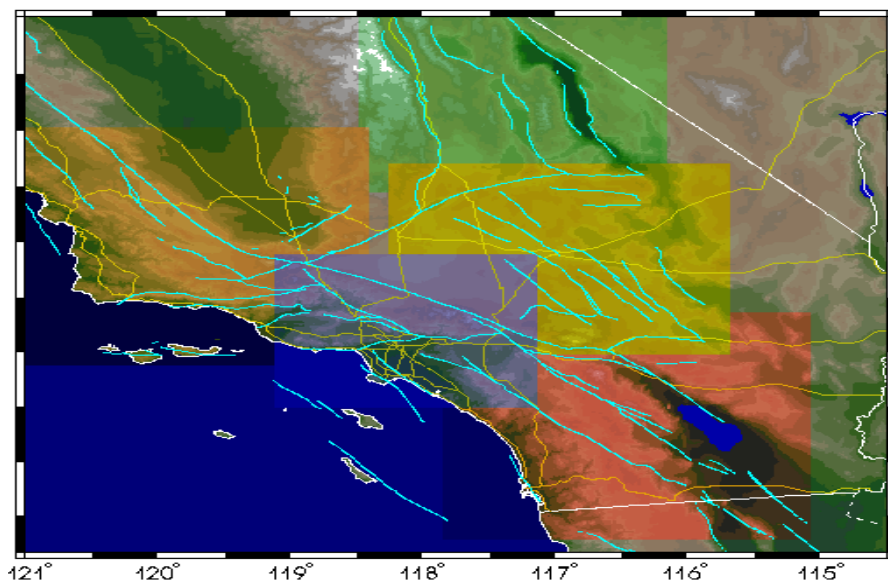
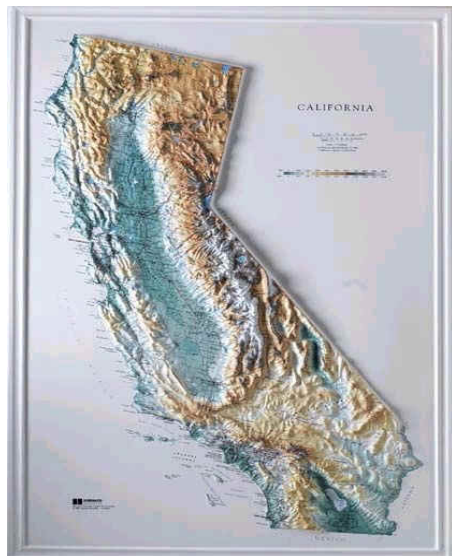
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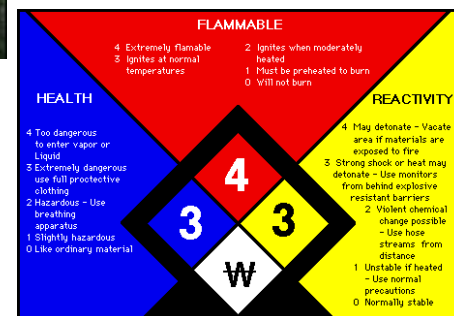


# Geographic Attractions & Hazards





# Chemicals Hazards





- ∞ Hazard Communication Standard (HAZCOM) 29 CFR 1910.1200 (h) (1) states that Employers provide their employees (at initial assignments and continuously)
- ∞ Training & Information
  - ∞ Hazardous chemicals
  - ∞ New physical or health hazard
  - ∞ Hazard Categories
    - ∞ flammability, carcinogenicity etc.
- ∞ **READILY AVAILABLE** chemical-specific information through hazard labels and (M)SDS
  - ∞ ***New (GHS) Hazcom waiting at OMB***
  - ∞ ***Adopted to UN Standards – revision after ~25 years***



# Chemical Hazard Analysis



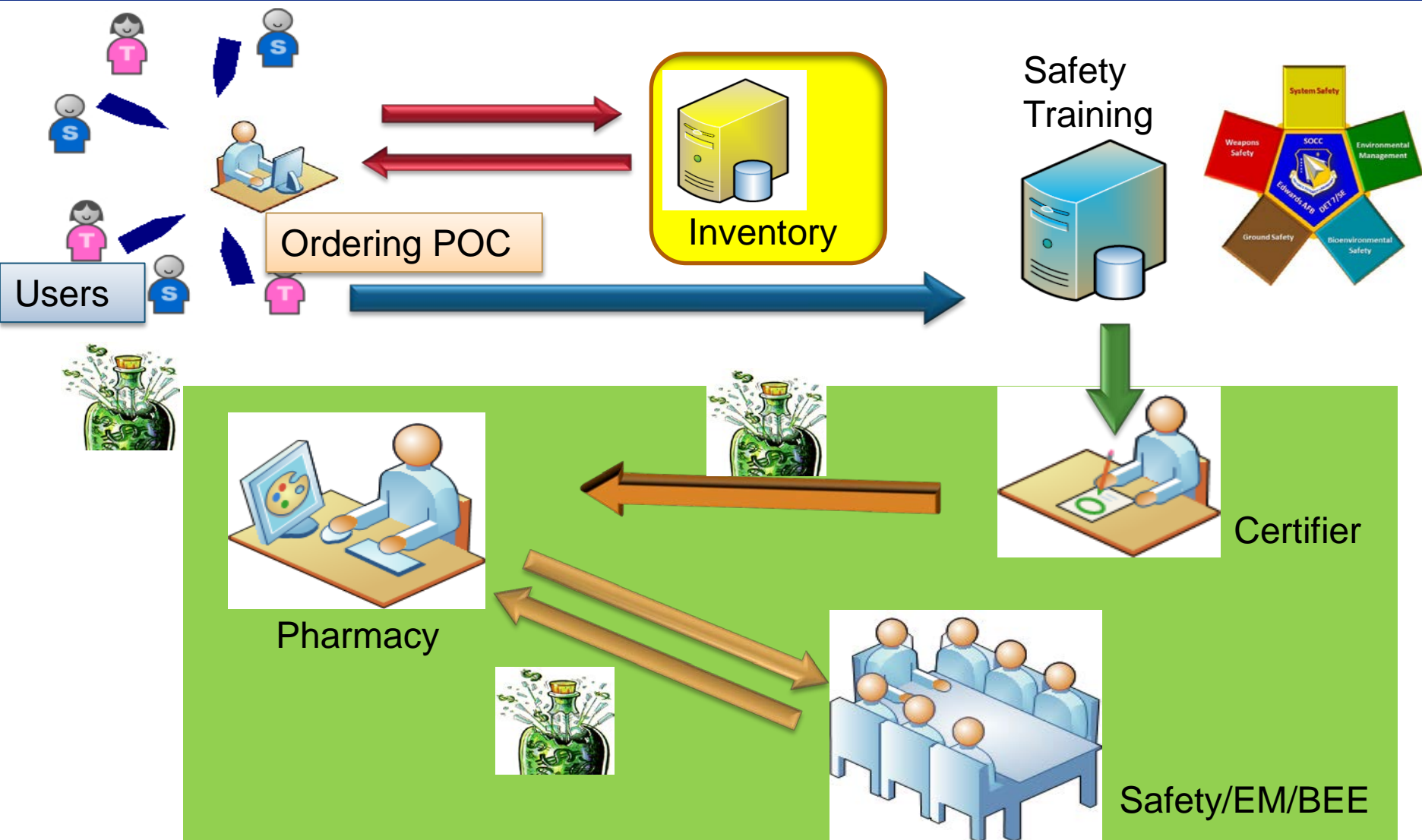
- Reactivity is an intrinsic property of a material
  - Understand the nature of the material
    - Training is very important
    - Use control measures
- Mitigating Flammability and Health Hazards
  - Engineering controls
  - Proper PPE
  - Removing ignition sources
  - Less important than Reactivity for Hazard classification?



Name of Material	
<input type="checkbox"/>	HEALTH
<input type="checkbox"/>	FLAMMABILITY
<input type="checkbox"/>	REACTIVITY
<input type="checkbox"/>	PROTECTIVE EQUIPMENT



# Current Chemical Procurement Process





# Need for a NEW SYSTEM

- **Researchers**
  - *Ordering & chemical procurement*
    - Current system too complicated – causes mission delays
- **Safety Office**
  - *Efficient processing of chemical licensing based on Hazard Rating Workflow*
- **Hazcom Program**
  - *Track the life-cycle of hazmat from conception to grave*
    - Ensure compliance with OSHA/EPA regulations
    - Avoid stockpiling of hazmat due to oversight/ multiple lab-wide inventory databases
- **First Responders/Fire Department**
  - *Emergency/disaster preparedness, quick information access on mobile devices*
- **Security Office**
  - *Tracking of explosives, munitions and chemicals of interest on the DHS and DEA lists*
- **Site Employees**
  - ***Right to Know (disclose hazards i.e., chemical, EM/X-ray radiation, laser etc.)***



# Enterprise Business Model



## ∞ DoD

### ∞ NAVY - North Point CA

- ∞ Uses a single (Master) database managed by a contractor

## ∞ Industry

### ∞ Pharmaceuticals – BMS (New Jersey)

- ∞ Tightest safety standards
- ∞ Risk of losing business
- ∞ Total accountability of ALL hazmat

## ∞ Academia

### ∞ USC, Los Angeles – CAPS

- ∞ Single database use with hazard information

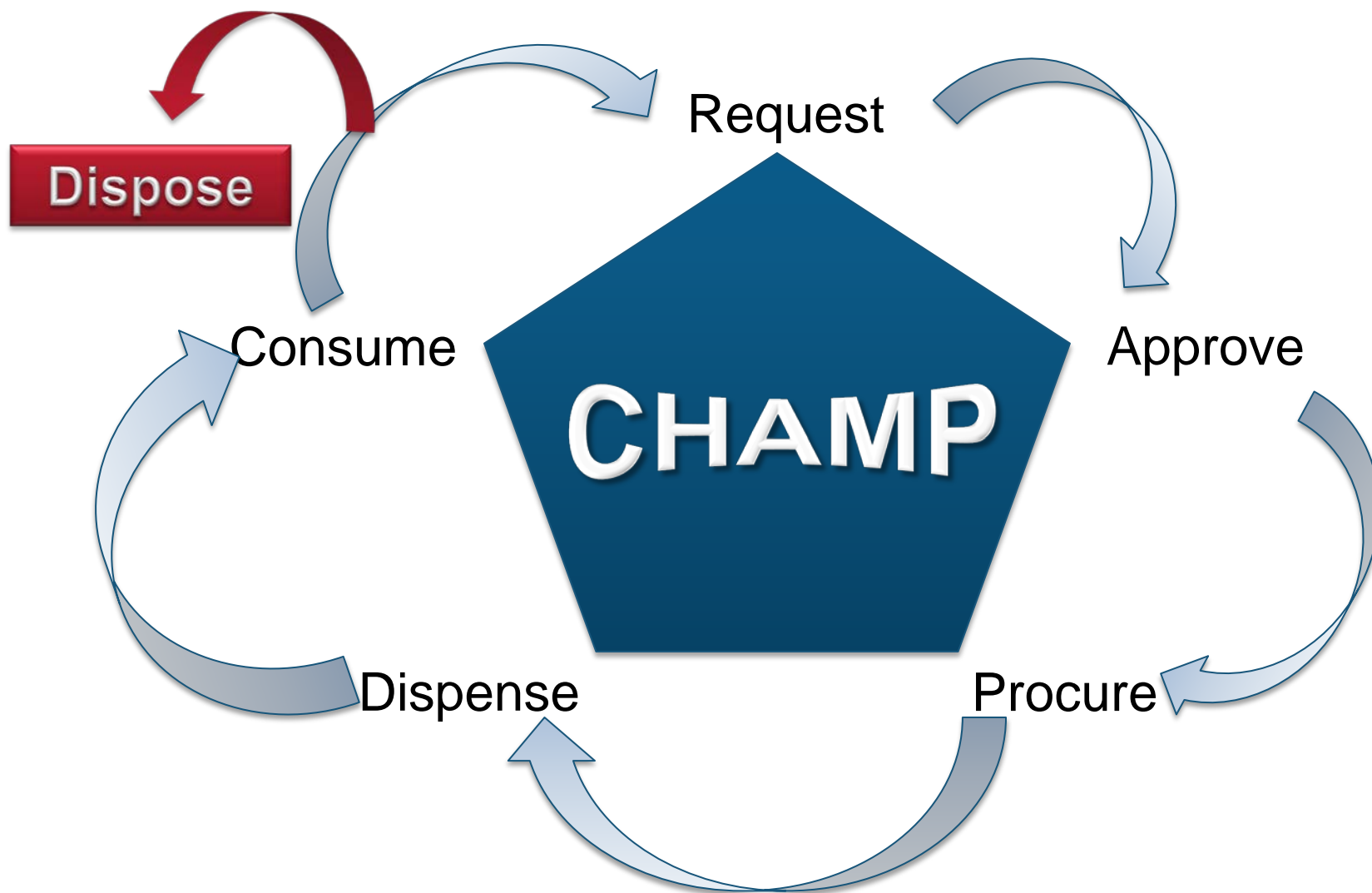


# Proposed Solution

## (CHAMP PROMO)



# Ideal CHAMP Lifecycle





# Measure of Chemical Hazards

- Use MSDS to determine the values associated with
  - Reactivity, Health, Flammability and Special properties
  - See if SPECIAL Property (Ox, Water Reactive) exists
  - Rate in the order
    - Reactivity > Health > Flammability



## ◦ **HAZARD RATING (HazRat) Proposal (single digit)**

- Special weights (Can be customized based on Engineering Controls)?
  - Special – ALWAYS a review and elevates risk to **MAXIMUM**
  - $R = 0.65, H = 0.25, F = 0.10$  or  $R=0.34, H = 0.33, F = 0.33$

$$HR \text{ (HazRat)} = R*0.65 + H*0.25 + F*0.10 \text{ (HMIS)}$$

$$HR \text{ (HazRat)} = R*0.34 + H*0.33 + F*0.33 \text{ (NFPA)}$$

Can be tuned based on engineering controls, trainings, PPE



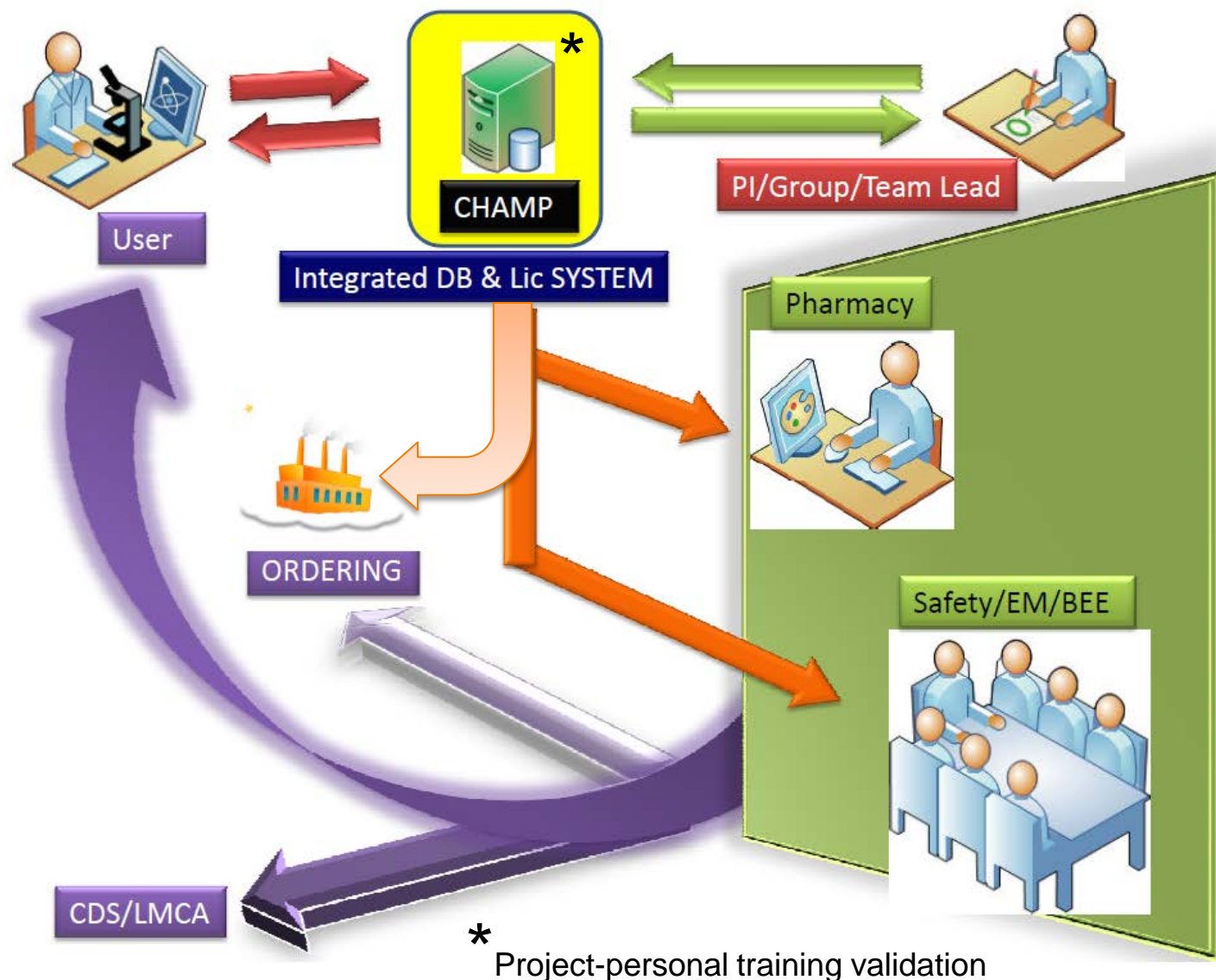
# Hazard Rating (HazRat) Based Workflow



- Make it convenient for researcher or the research facility to obtain a blanket license based on the HR number
- HR  $\geq 2$  all in the **RED ZONE**
  - *Mandatory review by Safety office*
- HR  $\geq 1$  BUT  $< 2$  will be in the **YELLOW ZONE**
  - *Discretionary review*
- HR  $< 1$  will be in the **GREEN ZONE**
  - Safe(r) stock chemicals/solvents
  - May qualify for blanket permit



# Proposed Process Streamlining





# CHAMP – Under the Hood

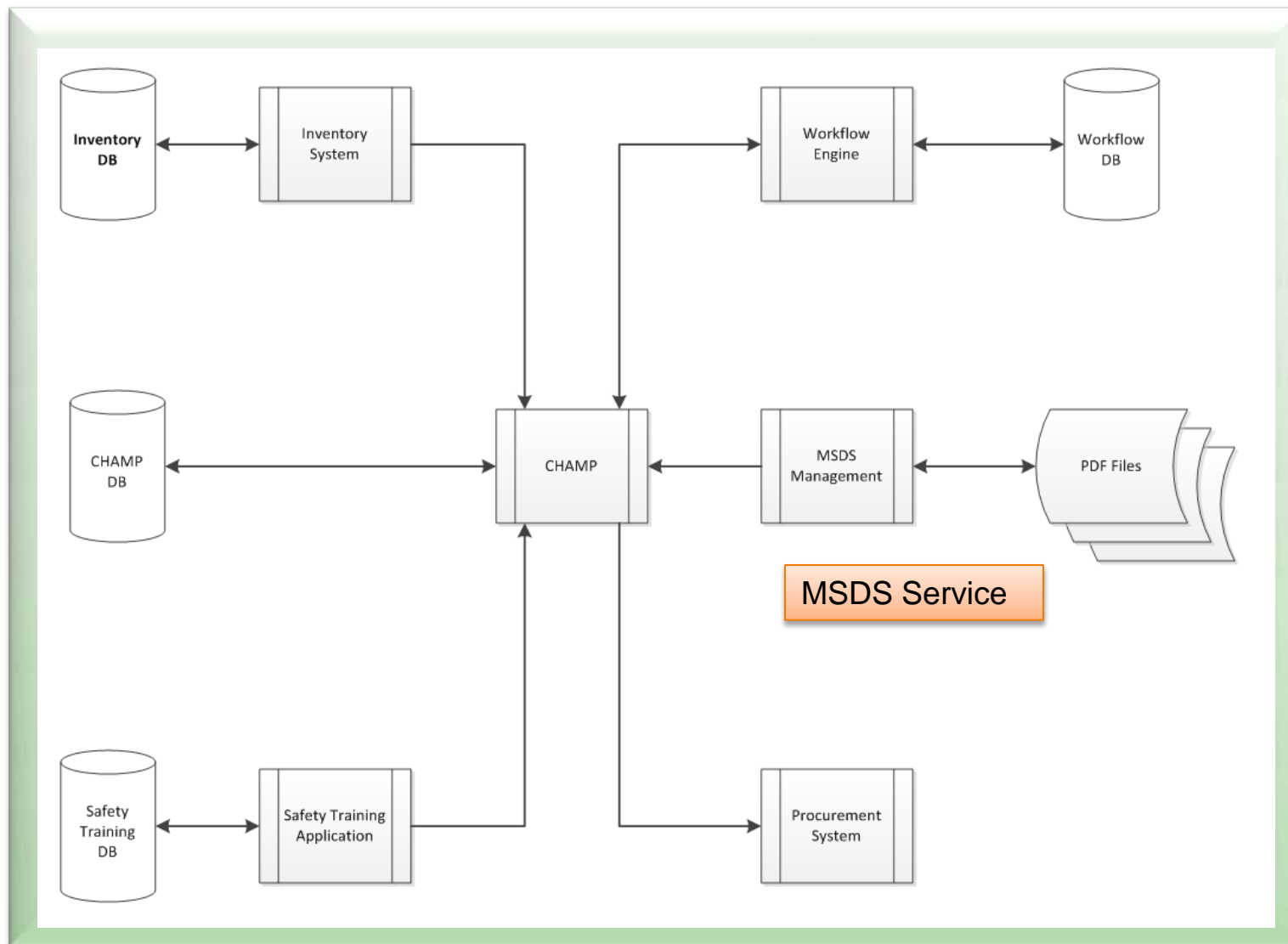


The New Web Based CHAMP System is:

- USAF Compliant platform (.NET/SQL2008)
- Interoperable with current DoD/NIH/NLM systems
- IT standard/compliant web technology
- Request using web forms
- Web-service capabilities ensuring data integrity
- Ensuring form completion before submittal
- Intelligent workflow based on “Hazard Rating”
- Integration into SharePoint/Outlook workflow

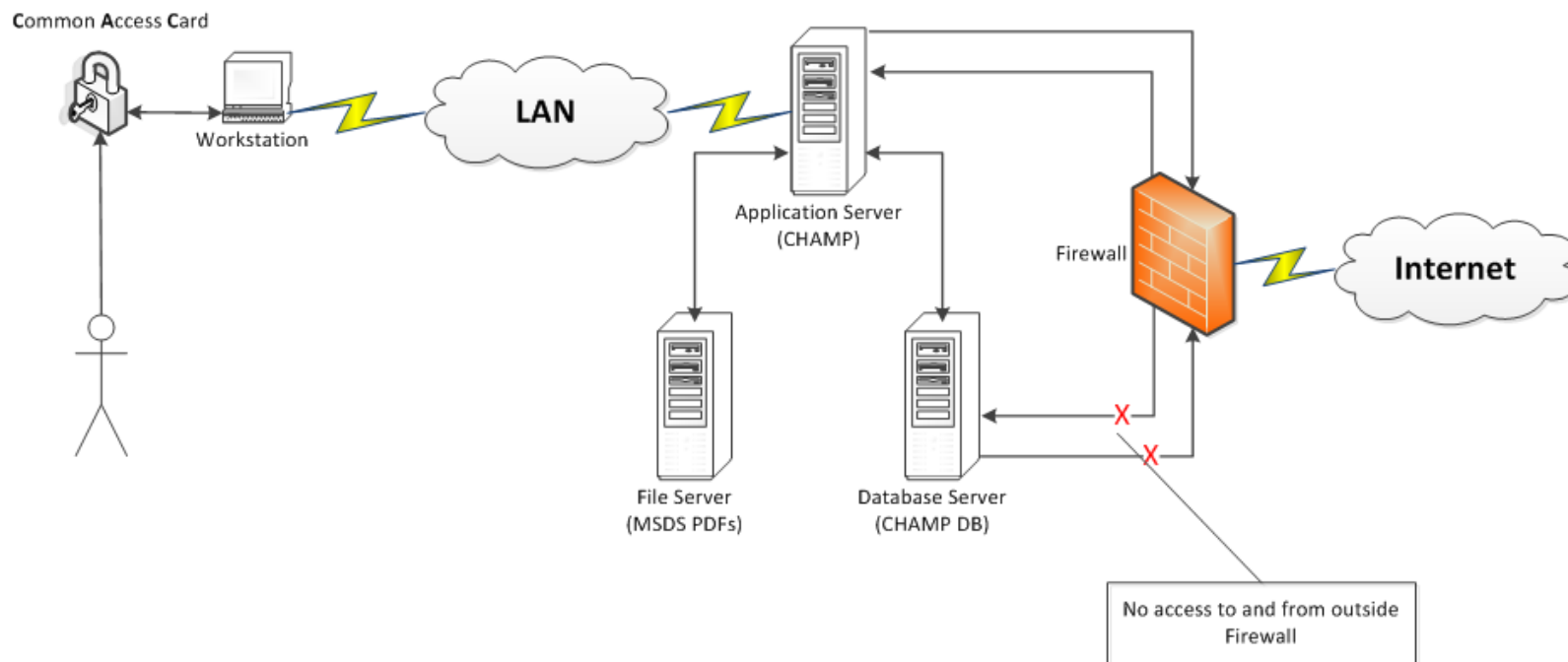


# CHAMP System Architecture





# CHAMP System Diagram



Stringent DoD network requirements – could be more flexible in academia



# Login Information Capture



Use of technology to validate user training, authorization to used specialized chemicals etc.

ASP.NET Framework for smooth integration with current Windows applications

http://localhost:2...rl=%2fdefault.aspx

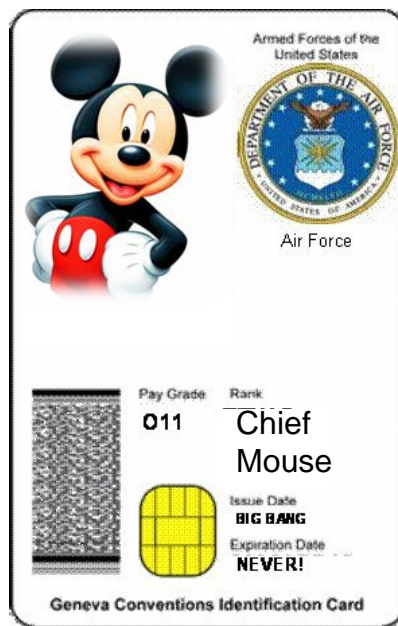
Log In

User Name:

Password:

Log In

Login required for each employee to check inventory, order chemicals – Meets USAF IT compliance requirements



- ∞ Capture User Info
  - ∞ Name
  - ∞ Contact Info
  - ∞ Location
  - ∞ Project No
  - ∞ Task No
  - ∞ Trainings
  - ∞ Supervisor
  - ∞ Work Location
  - ∞ Roles



# HazRat/HazInfo in Action



PyroTec

Chemical Hazard Analysis & Management Program - CHAMP



Welcome: Mickey Mouse

Logout

Home Search Request Approval Authorization Emergency Maintenance

PyroTec  
Chemical Hazard Analysis & Management Program - CHAMP

Welcome: Mickey Mouse Logout

Home Search Request Approval Authorization Emergency Maintenance

Search Inventory

Location (Building/Lab): 121 1 Search

Sortable Fields

CAS No.	Compound Name	Building	Lab	NFPA Health	NFPA Fire	NFPA Reactivity	NFPA Special	Hazard Rating (HR)
7702-65-2	Germane	121	1	4	4	3		3.67
1-115-113	Diethylaluminum chloride	121	1	3	4	3	W	3.34
1-115-114	Diethylzinc	121	1	3	4	3	W	3.34
107-02-8	Acrolein	121	1	4	3	3		3.33
71327-12-3	Nickel Carbonyl	121	1	4	3	3		3.33
1-115-171	Ethylaluminum dichloride	121	1	3	3	3	W	3.00
630-08-0	Carbon Monoxide	121	1	3	4	0		2.35
1-115-148	P-dioxane	121	1	2	3	1		2.01
1-115-151	Diisobutylamine	121	1	3	3	0		2.01
1-115-199	Mesityl Oxide	121	1	2	3	1		2.01
1-115-129	Decanol	121	1	0	2	0		0.68
76-22-2	Camphor	121	1	0	2	0		0.68
1-115-176	Diethanolamine	121	1	1	1	0		0.67
1-115-131	Hexadecane	121	1	0	1	0		0.34
1-115-138	Triethyl citrate	121	1	0	1	0		0.34

Quick sort of "bad actors" based on HazRat

Location (Building/Lab): 121 1 Search

Details Summary Contacts

Hazard Rating

HR 3.55

PPE requirements

PPE icons: Goggles, Gloves, Respirator, Hood, Boots, etc.

Location (Building/Lab): 121 1 Search

Details Summary Contacts

Emergency Contact Information

Building	Primary Contact	Phone	Secondary Contact	Phone
121	Mark Kelly	666-1111	Mickey Mouse	555-2222
122	Ashwani Vij	661-555-1212		
134	Suresh Tennarangam	555-3333		




# Source support for Emergency Responders



PyroTec

Chemical Hazard Analysis & Management Program - CHAMP

Welcome:  ouse

[Home](#) [Search](#) [Request](#) [Approval](#) [Authorization](#) [Emergency](#) [Maintenance](#)

[NIOSH Pocket Guide To Chemical Hazards](#)

[CHAMP 2 Min Promo](#)

[DOT Emergency Response Guide](#)

NIOSH / Pocket Guide to Chemical Hazards - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://localhost:2111/Content/Static/Niosh/nioshdb/npg/npgd0000.h

PyroTec

**NIOSH** The National Institute for Occupational Safety and Health **CDC**

## NIOSH Pocket Guide to Chemical Hazards

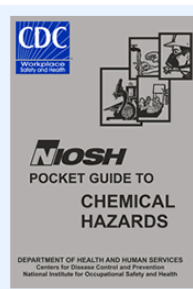
INDEX of Chemical Names, Synonyms and Trade Names

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

**A**

SEQ	CHEMICAL NAME	CAS No.	RTECS No.
0017	AA	107-18-6	BA5075000
0007	2-AAF	53-96-3	AB9450000
0007	AAF	53-96-3	AB9450000
0589	Abate®	3383-96-8	TF6890000
0001*	Acetaldehyde	75-07-0	AB1925000
0007	2-Acetaminofluorene	53-96-3	AB9450000

Done 00:00



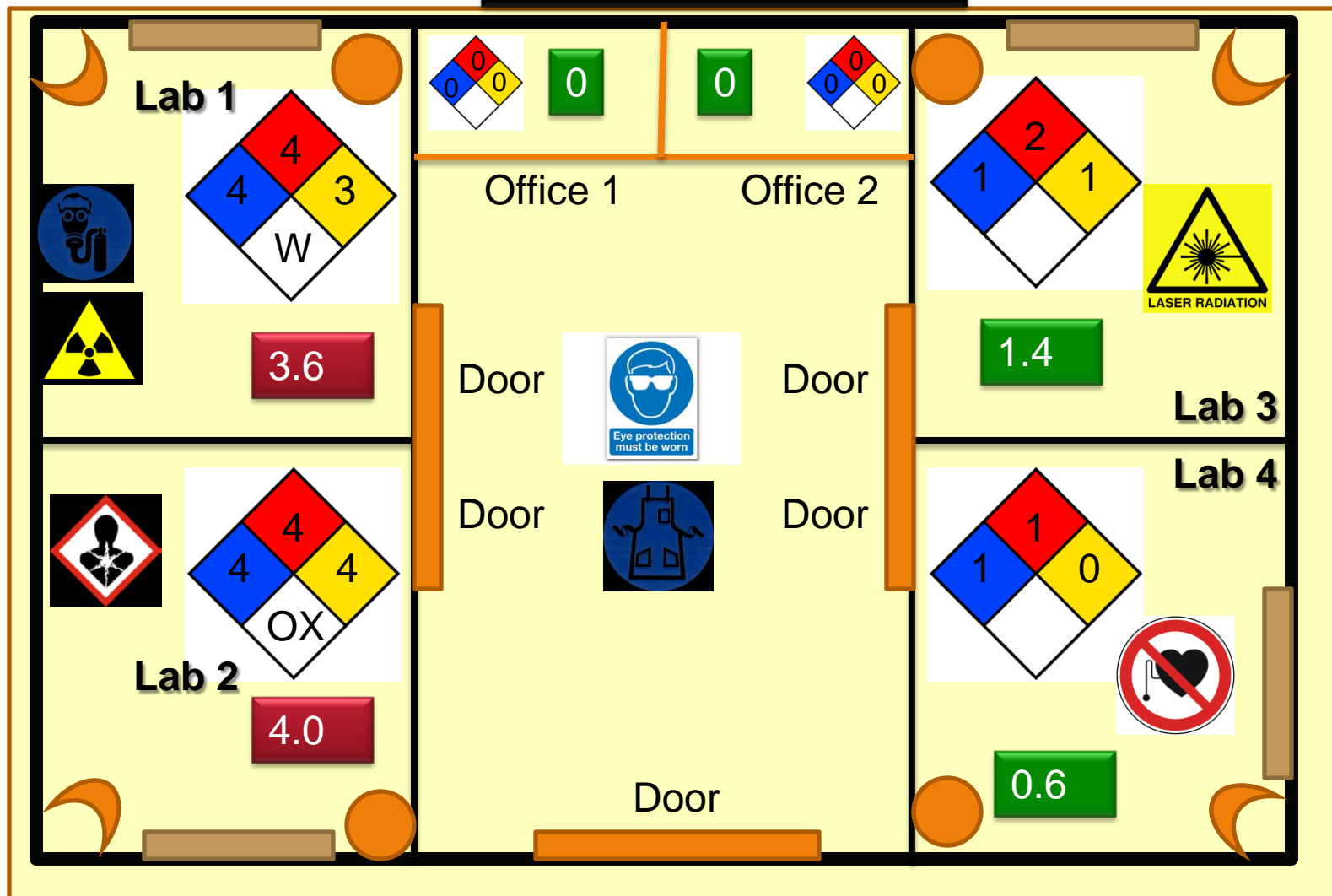
## Emergency Response Guidebook





# “GIS” mapping of facility

Floor Map of Bldg XYZ



Fume hood

0.6

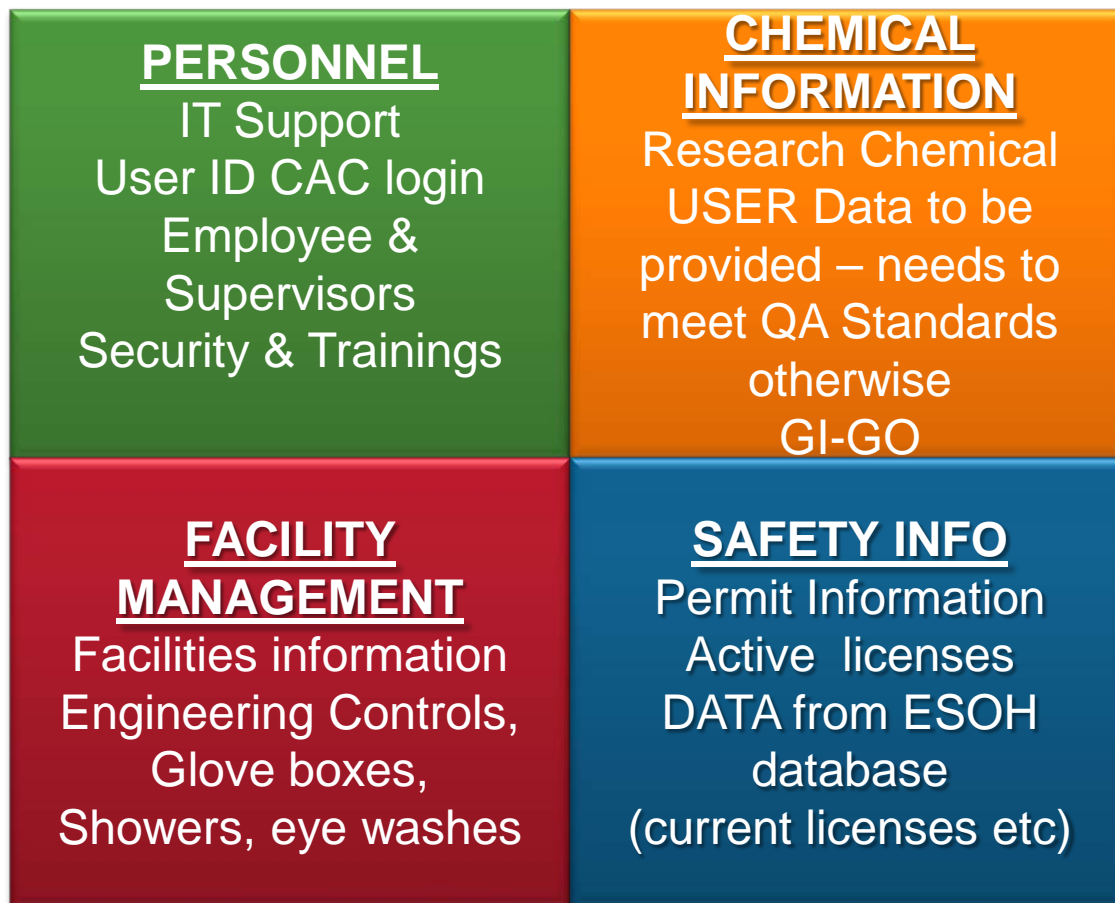
Green Area\*

4.0

RED Area\*



# Centralization & System Integration





# Application Benefits

- Prevent Inadvertent Chemical Exposure
- Prevent Personal INJURY due to inadequate risk evaluation
- Prevent injury to First Responders (Fire/Medics)
- Reduce disposal cost from stockpiling
- Increase productivity, boost morale
- Allow R&D to stay mission focused
- *Process leaning will help save over 0.5M over next 5 years*



# Acknowledgments



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Dr. Shawn Phillips,  
Deputy RZS

Ms. Debra Fuller,  
Chief of Safety

Dr. Pertti Hakkinen  
NIH/NLM

Mr. Tuong Chu,  
System Safety Engineer

\$\$

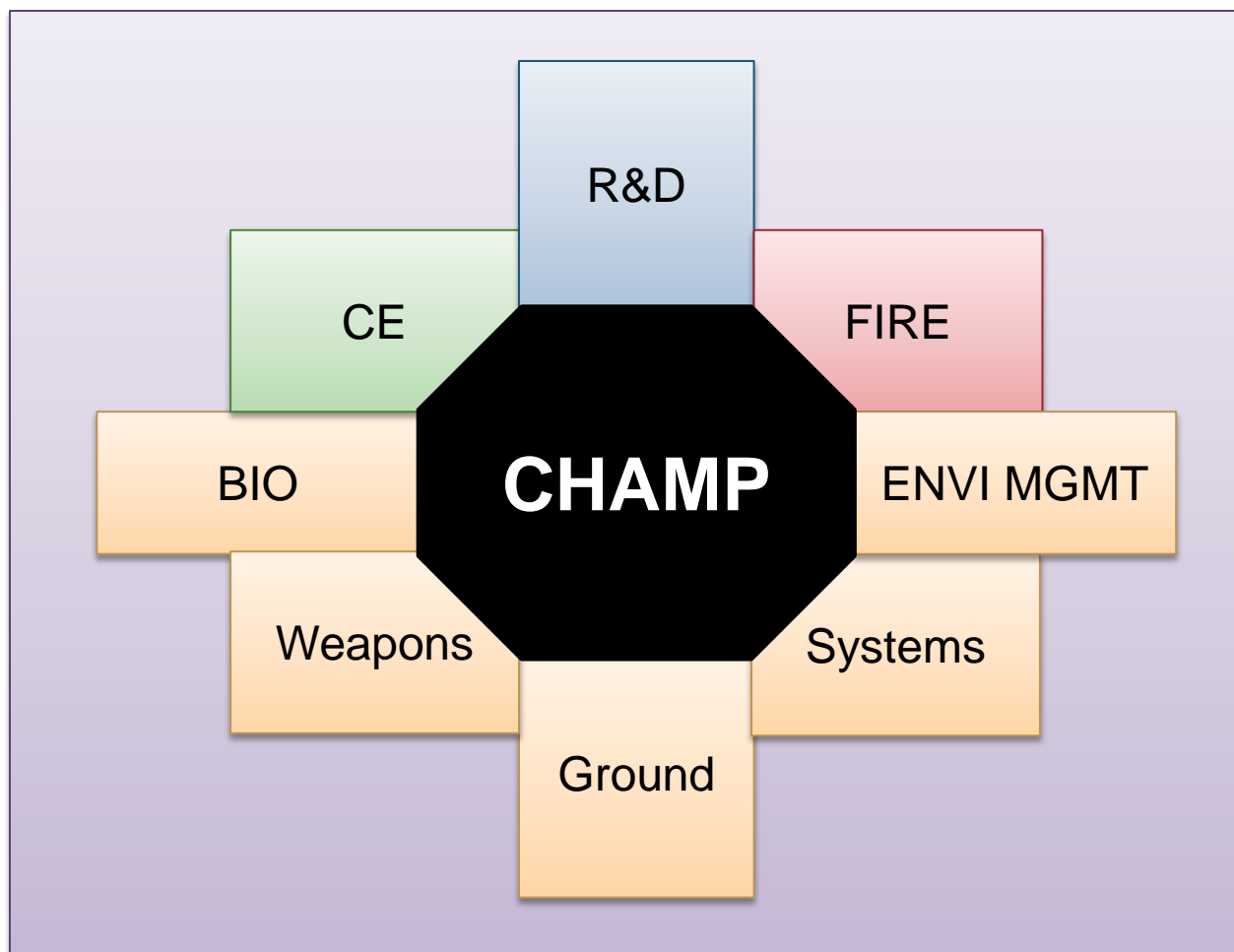
Air Force Research Laboratory, Edwards



# Backup



# Why a new system



## Cross-functional Setup

R&D

FIRE

CE

Systems

Ground

Weapons

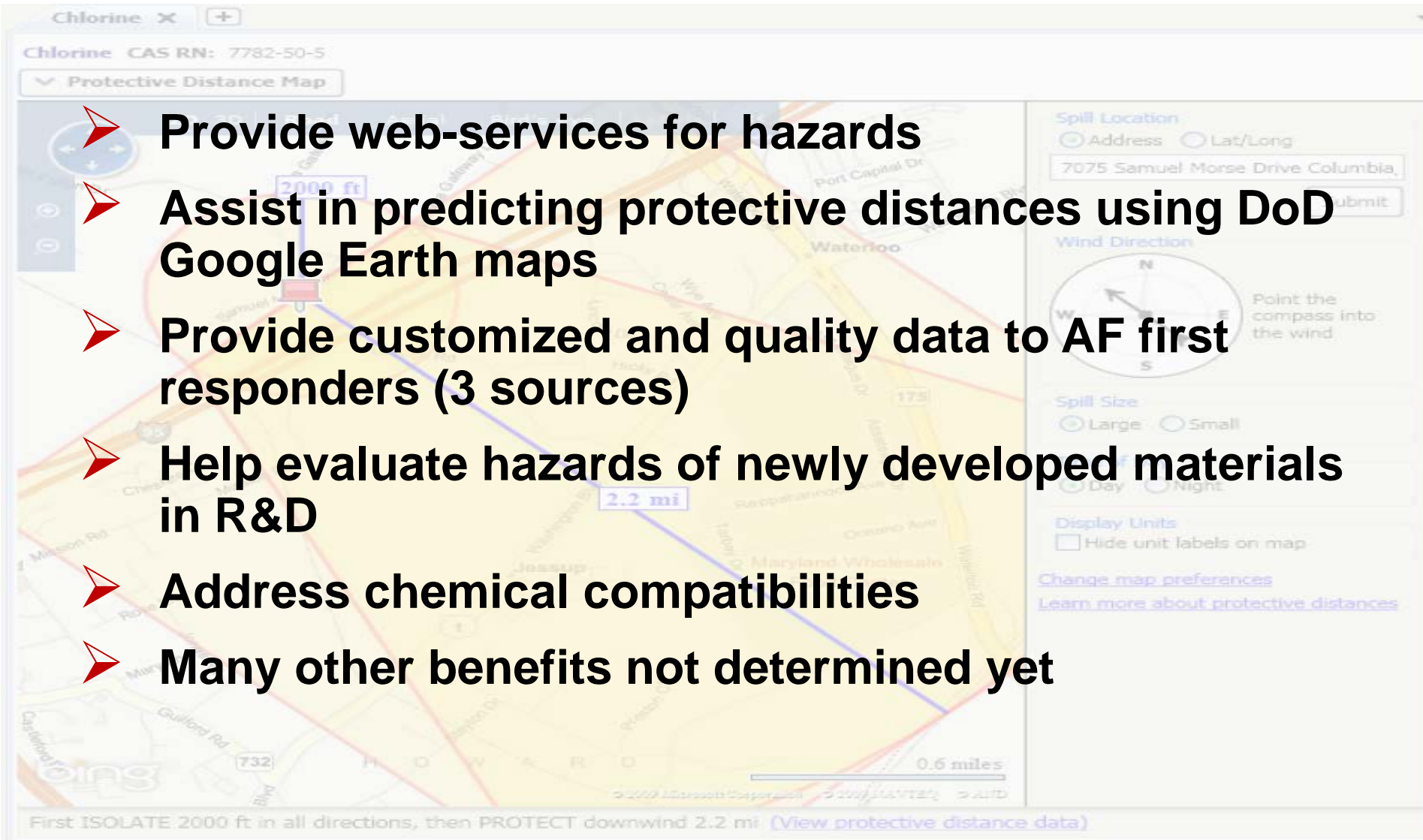
BIO

Environ-  
mental



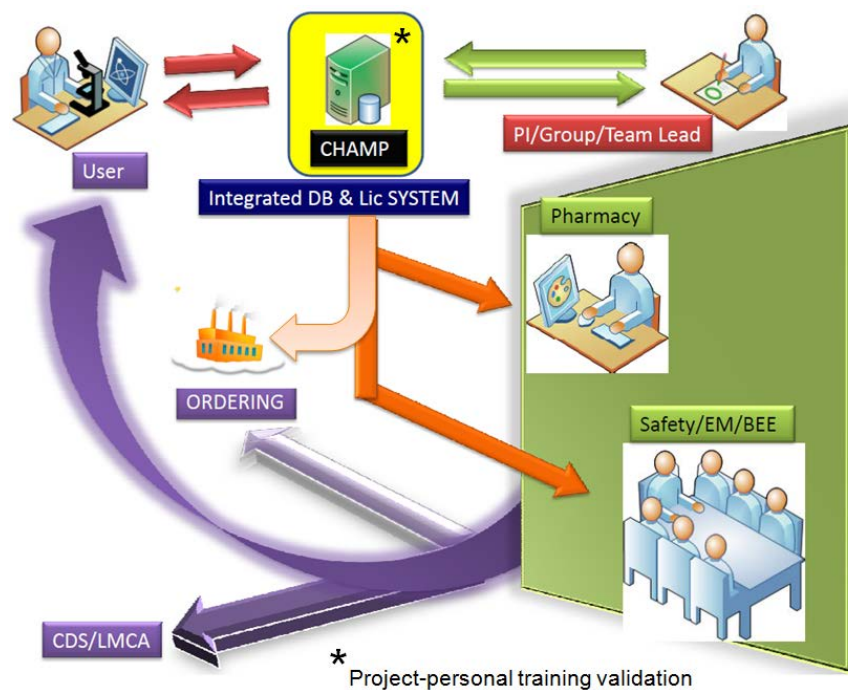
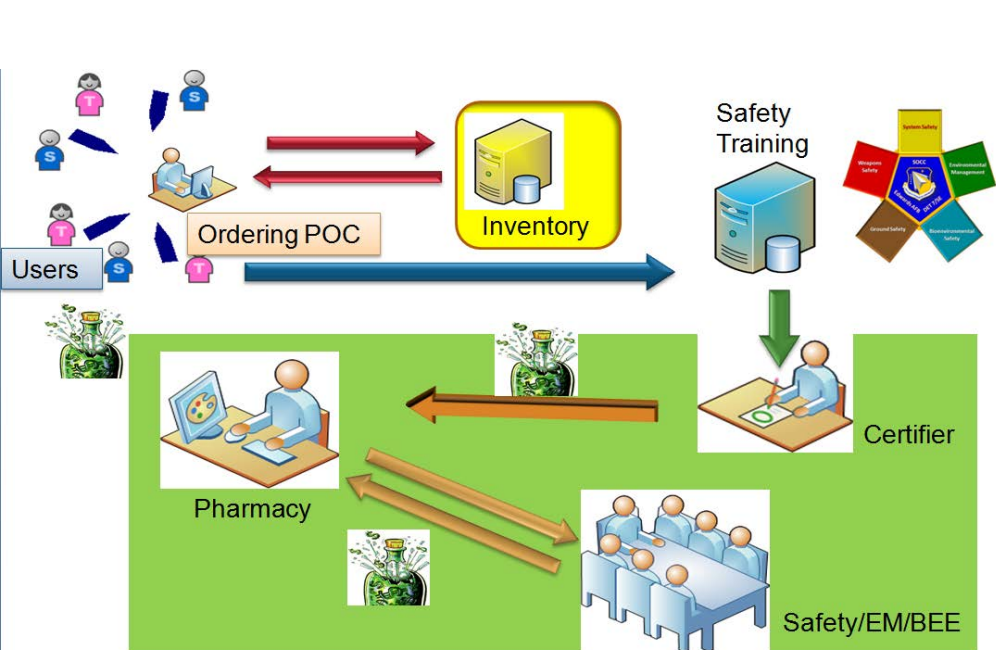
# Wiser-CHAMP integration

- Provide web-services for hazards
- Assist in predicting protective distances using DoD Google Earth maps
- Provide customized and quality data to AF first responders (3 sources)
- Help evaluate hazards of newly developed materials in R&D
- Address chemical compatibilities
- Many other benefits not determined yet





# Side by side comparison of process





# Location Based Hazard Risk



Same chemical may pose different hazards based on location/personnel



## R&D Lab

- Handled by SMEs
- Fume hoods
- PPE
- Engineering controls



## Hazmat Stockroom

- Handled by hazcom trained employees
- May or may not have fume hoods
- PPE



## Receiving Office

- NO Fume hoods
- PPE use?
- Handled by logistics employees



## Transportation\* – spills & leaks



Each phase should have it's unique risk mitigation strategy

\* DOT compliance  
for transportation